GCSE (9–1)

Chemistry A (Gateway Science)

J248/01: Paper 1 (Foundation Tier)

General Certificate of Secondary Education

2021 Mark Scheme (DRAFT)

This is a DRAFT mark scheme. It has not been used for marking as this paper did not receive any entries in the series it was scheduled for. It is therefore possible that not all valid approaches to a question may be captured in this version. You should give credit to such responses when marking learner's work.

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

1. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

2. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

3. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

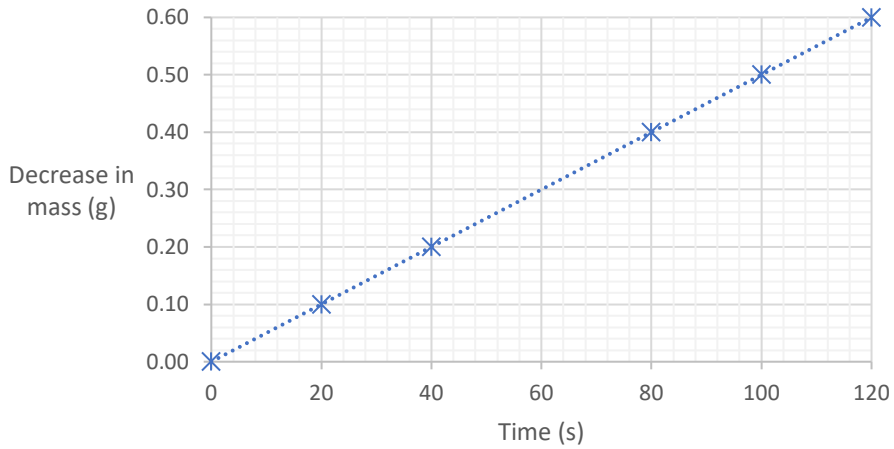
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Chemistry A:

	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.**
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	**Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.**
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question	Answer	Marks	AO element	Guidance
1	D ✓	1	1.1	
2	C ✓	1	1.1	
3	B ✓	1	2.2	
4	A ✓	1	2.1	
5	C ✓	1	1.1	
6	D ✓	1	2.1	
7	A ✓	1	2.1	
8	C ✓	1	1.2	
9	A ✓	1	1.2	
10	D ✓	1	2.1	
11	D ✓	1	2.1	
12	C ✓	1	2.2	
13	B ✓	1	2.1	
14	C ✓	1	1.2	
15	C ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
16	(a)		Mg ✓ HCl ✓	2	1.1	
	(b)		Aqueous ✓	1	1.1	
	(c)	(i)	Hydrogen is a gas / a gas is produced ✓ Idea that the gas can escape (from the beaker) ✓	2	1.1 2.2	
		(ii)	 All three points plotted correctly ✓ Line of best fit drawn ✓	2	 2.2 1.2	 **ALLOW** ± ½ square
		(iii)	Answer ±0.02g of the line of best fit ✓	1	2.2	Scores 0 if no line of best fit in 16(c)(ii)
	(d)	(i)	Experiment 2 / 0.69 ✓	1	3.2b	

Question			Answer	Marks	AO element	Guidance
16	(d)	(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.63 (g) award 3 marks** 0.60+0.62+0.59 = 1.81 ✓ 1.81 / 3 = 0.603 ✓ 0.60 (g) (2 significant figures) ✓	**3**	**2 x 2.2** **1.2**	**ALLOW** ECF from incorrect mean for sig fig mark

Question			Answer	Marks	AO element	Guidance
17	(a)		**Any one from:** Chemical properties are based on atomic number/number of protons ✓ Relative atomic mass includes neutrons / mass number is protons and neutrons, so atomic number and atomic mass order are not always consistent / AW ✓	1	1.1	
	(b)		**Any one from:** Ar and K / argon and potassium ✓ Co and Ni / cobalt and nickel ✓ Te and I / tellurium and iodine ✓	1	1.1	
	(c)	(i)	Z ✓ Identifies element as a group 0 / 8 / 18 element / noble gas ✓	2	3.2b 2.1	
		(ii)	X ✓ Identifies element as a metal ✓	2	3.2b 2.1	

Question			Answer	Marks	AO element	Guidance
18	(a)	(i)	Solvent / water / ethanol ✓	1	1.2	**ALLOW** other suitable named solvent
		(ii)	To stop the mobile phase / solvent evaporating ✓	1	1.2	**ALLOW** named solvent from (a)(i)
	(b)	(i)	(Yes) Sample 4 is a pure substance ✓ It only contains one spot ✓	2	3.1b	
		(ii)	Idea of a substance containing only a single element or compound ✓	1	1.1	
		(iii)	1 and 3 ✓	1	2.2	
	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 40 (%) award 3 marks** 0.45 ÷ (0.5 + 0.45 + 0.16) = 0.4045 ✓ 0.4045 x 100 = 40.54 ✓ 41 (2 significant figures) ✓	3	 **2 x 2.2** **1.2**	 **ALLOW** ECF for sig fig mark
		(ii)	Sample 2 ✓	1	3.2b	
		(iii)	**Any one from:** Gas chromatography shows amounts / quantities of compounds ✓ Thin layer chromatography doesn't show amounts / quantities of compounds ✓	1	1.2	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>19</td><td>(a)</td><td></td><td>
<table>
<tr><th>Species</th><th>Cation</th><th>Anion</th></tr>
<tr><td>NaOH</td><td>Na⁺</td><td>OH⁻✓</td></tr>
<tr><td>H₂SO₄</td><td>H⁺✓</td><td>SO₄⁻</td></tr>
</table>
</td><td>2</td><td>2.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>(No)

pH 9 is alkaline / pH 9 is not acidic ✓

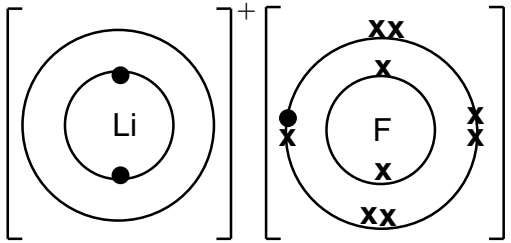
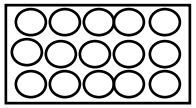
Alkaline solutions contain OH^- ions ✓</td><td>2</td><td>3.1b</td><td>Marks are for explanation</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>pH probe 7 ✓

Universal indicator green ✓</td><td>2</td><td>1.2</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>2 $NaOH + H_2SO_4 \rightarrow Na_2SO_4 +$ 2 H_2O

H_2O ✓
Balanced equation ✓</td><td>2</td><td>2.1</td><td>Balancing mark is dependent on the correct formula</td></tr>
<tr><td></td><td>(d)</td><td></td><td>Z ✓</td><td>1</td><td>3.2b</td><td></td></tr>
</table>

Question			Answer	Marks	AO Element	Guidance
20	(a)		(Nanoparticle) A ✓ Idea of highest surface area to volume ratio ✓	2	3.2a	
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 24 (nm^2), award 2 marks** (SA of one face =) 2 x 2 = 4 (nm^2) ✓ (Total SA =) 6 x 4 = 24 (nm^2) ✓	2	2.2	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 3, award 2 marks** Ratio = SA ÷ V = 24 ÷ 8 ✓ = 3 ✓	2	2.2	**ALLOW** ECF from incorrect answer to 20 (b)(i) **ALLOW** ratios, for example, 3:1
	(c)		Idea that the long-term side effects are not known ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
21	(a)*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Detailed description of the advantages of dot and cross and 3D models linked to ammonia. **AND** Detailed description of the limitations of dot and cross and 3D models linked to ammonia. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Detailed description of the advantages of dot and cross diagrams **AND** Detailed description of the limitations of dot and cross diagrams **OR** Detailed description of the advantages of 3D models **AND** Detailed description of the limitations of 3D models. **OR** Description of the advantages of dot and cross diagrams and 3D models. **AND** Description of the limitations of dot and cross diagrams and 3D models.	**6**	**4 x 1.1** **2 x 2.1**	**AO1.1 Knowledge of advantages and limitations of models may include:** • Dot and cross diagrams show electronic arrangement • Dot and cross diagrams show lone pairs of electrons/electrons that are non-bonding • Dot and cross diagrams show single bonds vs. double bonds/bond order • 3D space filling model shows the relative size of atoms • 3D space filling model shows the 3D shape of the molecule/direction of the bonds **AO2.1 Advantages and limitations of models applied to ammonia may include:** • Dot and cross diagrams show a lone pair of electrons on nitrogen. • Dot and cross diagram does not show the 3D shape of ammonia/ammonia appears flat in dot and cross diagram • 3D space filling model show nitrogen is larger than hydrogen

Question			Answer	Marks	AO element	Guidance
			There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence. **Level 1 (1–2 marks)** Describes an advantage of a model/diagram. **OR** Describes a limitation of a model/diagram. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*			
	(b)		 Lithium ion ✓ Fluoride ion ✓	**2**	**2.2**	**ALLOW** charges shown as 1+ or +1 for lithium; 1- or -1 for fluoride **ALLOW** charges given on chemical symbol **ALLOW** one mark for two correct electronic structures with no charges **DO NOT ALLOW** shared electrons All electrons can be dots or crosses
	(c)		Idea that particles are tightly / closely packed ✓ Idea that particles have a regular arrangement / are not randomly arranged ✓	**2**	**1.1**	**ALLOW** marking points expressed in diagram form, for example: 

Question			Answer	Marks	AO element	Guidance
	(d)		Lithium fluoride has weak intermolecular forces. ☐ Lithium fluoride can conduct electricity in the solid state. ☐ Lithium fluoride contains metal and non-metal elements. ✓ ✓ Lithium fluoride is a salt formed from lithium hydroxide and hydrofluoric acid. ✓ ✓ Lithium fluoride has a low melting point. ☐	2	2.1	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>22</td><td>(a)</td><td></td><td><table><tr><th>Allotrope</th><th>Covalent bonds</th></tr><tr><td>Diamond</td><td>4✓</td></tr><tr><td>Graphite</td><td>3✓</td></tr><tr><td>Graphene</td><td>3</td></tr></table></td><td>2</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Diamond has many strong covalent bonds ✓

Which require a lot of energy to break ✓</td><td>2</td><td>1.1</td><td>ALLOW idea that each carbon atom forms 4 strong covalent bonds / diamond is a giant covalent structure / diamond is macromolecular
DO NOT ALLOW references to intermolecular forces or ionic bonds – scores 0 for question

ALLOW idea that the bonds are hard to break</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any two from:
Graphite forms layers of (covalently bonded) carbon atoms✓

Idea that graphite has weak(er) intermolecular forces/weak forces between layers ✓

Layers can slide/slip over each other✓</td><td>2</td><td>1.1</td><td>DO NOT ALLOW references to ionic bonds – scores 0 for question

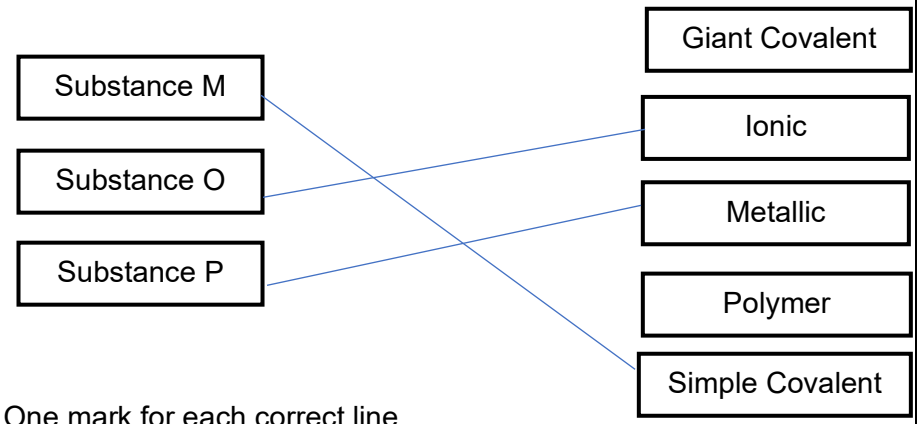
ALLOW sheets for layers</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Any two from:

Carbon/it can bond to itself✓

Carbon/it can form families/groups/series of compounds✓

Idea that carbon forms four bonds, which gives different bonding possibilities to different elements ✓

Idea that carbon can form single or double bonds (in different compounds) ✓</td><td>2</td><td>1.1</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
23	(a)		Second box ticked ✓	1	3.2b	
	(b)	(i)	Add water to the mixture (to dissolve substance O) ✓ Filter to obtain a pure sample of substance P ✓ Evaporate / boil / distil off water to obtain a pure sample of substance O ✓	3	3.3a	Answer must relate to P and O and be in the correct order
	(b)	(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 4.19, award 3 marks** 2.6/6.2 = 0.41935.. ✓ 0.41935 x 10 = 4.1935 ✓ 4.19 (3 significant figures) ✓	3	**2 x 2.2** **1.2**	**ALLOW** ECF from incorrect division if answer x 10 **ALLOW** ECF for sig fig mark
	(c)		 One mark for each correct line	3	3.2b	

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